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Potato Disease Control Studies On The Maryland Eastern Shore

By
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The University of Maryland
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The University of Maryland
Agricultural Experiment Station

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The University of Maryland
Agricultural Experiment Station

Bulletin No. 433 May, 1940

POTATO DISEASE CONTROL STUDIES ON THE MARYLAND EASTERN SHORE

By Dr. R. A. Jehle*

THE potato is one of the most important crops produced on the Eastern Shore of Maryland. It is grown on practically every farm and frequently supplies the largest portion of the cash income. The studies reported herein were undertaken in response to requests from potato growers for information on the nature and control of diseases and other factors which were resulting in reduced yields and inferior quality. A careful survey was made of commercial potato-producing regions, and the following studies were considered necessary to solve the problems of Eastern Shore potato growers:

1. Comparison of various sources of seed for the early potato crop.
2. Effect of various storage temperatures on the late home-grown seed potatoes.
3. Best practices for the production of a late, healthy seed crop.
4. Studies with the use of seed potatoes from the early crop for planting the late seed crop.
5. Studies of potato varieties and seedlings with special reference to disease resistance.
6. Spraying and dusting studies.

*Specialist in Plant Pathology for the University of Maryland Extension Service and Experiment Station. At various times the writer has been assisted in these studies by E. I. Oswald, Assistant Director of Extension; R. T. Grant, County Agent, Worcester County; Dr. J. W. Heuberger, formerly Assistant Specialist in Plant Pathology, and Dr. E. A. Walker, Assistant Specialist in Plant Pathology. The writer wishes to acknowledge his indebtedness to Willard T. Pilchard, William S. Friend, and William P. DeBerry for their valuable assistance in planting and caring for experimental plots located on their farms, also to T. H. White, formerly Olericulturist, Department of Horticulture, University of Maryland, for valuable assistance and suggestions.

SOURCES OF SEED FOR THE EARLY POTATO CROP

In a comparison of various sources of seed for production of the early Eastern Shore potato crop,* an effort was made to include all sources of seed which were likely to be used. Not only was seed obtained from various localities, but also from different individuals in the same locality. A comparison was made also between certified and uncertified seed from the same locality. Seed stocks from growers in the following states and provinces were compared: Kentucky, Maine, Maryland, Michigan, Minnesota, New Brunswick, New Jersey, New York, North and South Dakotas, Ontario, Prince Edward Island, Vermont, Virginia, and Wisconsin.

The seed stocks grown in these different states and provinces gave wide variations in yields, in the number of diseased plants produced, in the stage of sprout development of the tubers, in the firmness of the tubers, in the amount of flesh discoloration in the tubers, and in other characteristics; just as great varia-

FIG. 1

Comparison of Irish Cobbler potatoes grown from Maine certified and Maine uncertified seed on the farm of E. T. Taylor, Snow Hill, Maryland. Dwarfing of the plants in the two left-hand rows grown from uncertified seed was due to the presence of virus diseases.

*Results of five years' studies were published in 1929 (14).

tion was found between seed stocks obtained from different growers in the same locality. From these results, it is evident that, in the purchase of seed for the early potato crop, it is more important for the Eastern Shore potato grower to be guided by the reputation of individual seed growers than by the reputation of the various seed-growing states and provinces.

The average yield obtained from certified seed in comparative studies was larger than the average yield obtained from uncertified seed (see table). There are, however, more important reasons for avoiding uncertified seed than the risk of obtaining poor yields. Growers who plant uncertified seed are constantly running the risk of introducing destructive diseases and insects onto their farms, thereby making it increasingly difficult to produce a profitable crop of potatoes. The use of uncertified seed is especially hazardous at the present time on account of the danger of introducing bacterial ring rot with the seed. This is a new, destructive disease which has recently appeared in many potato-growing regions including some of the most important seed-producing localities.* All fields in which this disease is found are disqualified for certification. Disqualified seed is frequently sold under some misleading name, as "selected seed," "improved seed," etc. There is, therefore, much greater danger of introducing bacterial ring rot with uncertified seed than with certified seed. There is always an adequate supply of certified seed available for the potato grower since practically all seed potato-growing states, including Maryland (12),** have a seed potato certification service.

EFFECT OF STORAGE TEMPERATURE

As a result of studies with various seed sources for production of the early Eastern Shore potato crop, the writer and associate (14) have found that when home-grown Irish Cobbler seed potatoes were planted at the same time as northern-grown Irish Cobbler seed potatoes, they came up and matured later and usually yielded less. In spite of these handicaps, most Eastern Shore potato growers have preferred to plant at least a portion of their early crop with home-grown seed. Eastern Shore potato growers usually harvest their late seed potato crop early in November and keep it in unheated basements until early in March, when it is removed for cutting and planting. White (30) found that late-grown Eastern Shore Virginia seed kept in a heated basement for a period of one month before planting came up and matured almost as early as Maine-grown seed. The writer and associate (16) found that when late home-grown Eastern Shore Irish Cobbler seed stock was planted in Garrett

*Bonde, Wyman, and Eddins have published descriptions of bacterial ring rot (4, 5 and 11).

**Figures in parentheses refer to order of literature cited.

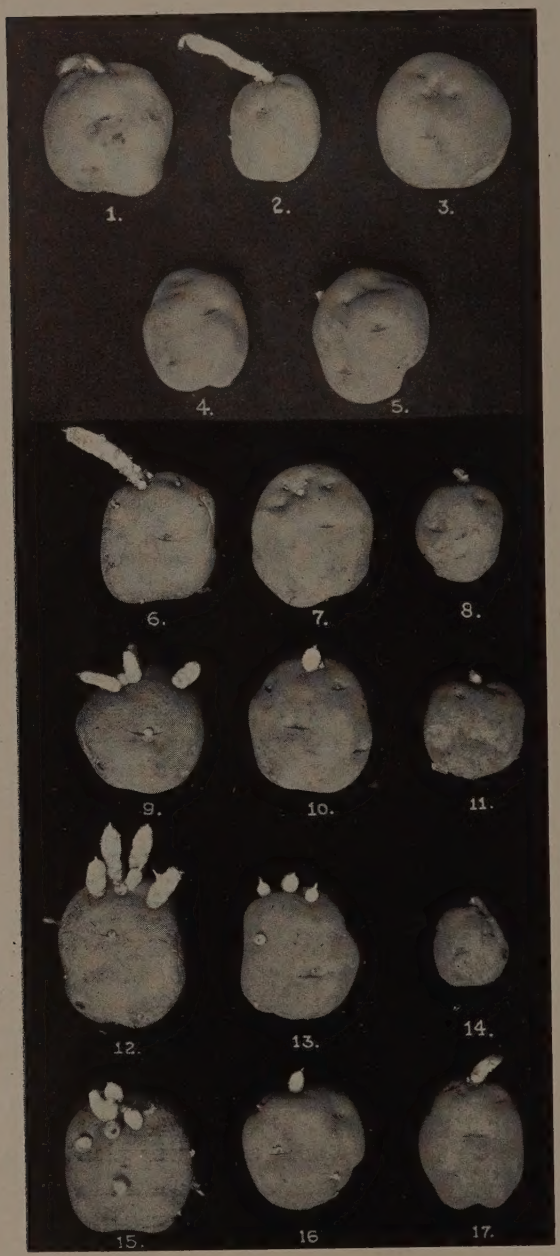

FIG. 2

FIG. 2.

*Effect of Storage Temperature on Sprout Development of Irish Cobbler Seed Potatoes**

Garrett County grown seed was dug August 28.

Eastern Shore late grown seed was dug November 2.

The temperature of the unheated basement was approximately 40°-45° F.

The temperature of the heated basement was approximately 60°-65° F.

The temperature of the sweet potato storage house was approximately 55° F.

The Garrett County grown seed was kept in a well ventilated shed until it was placed in storage.

1. Maine grown seed kept under typical storage conditions.
2. Garrett County grown seed stored in an unheated basement from November 5 to March 18.
3. Garrett County grown seed stored at 40° F. from November 14 to March 20.
4. Eastern Shore grown seed stored in an unheated basement from November 5 to March 18.
5. Eastern Shore grown seed stored at 40° F. from November 14 to March 20.
6. Garrett County grown seed stored at 50° F. from November 14 to March 20.
7. Eastern Shore grown seed stored at 50° F. from November 14 to March 20.
8. Eastern Shore grown seed stored in a sweet potato storage house from November 5 to March 18.
9. Garrett County grown seed stored at 40° F. from November 14 to February 15 and at 60° F. from February 15 to March 20.
10. Eastern Shore grown seed stored at 40° F. from November 14 to February 15 and at 60° F. from February 15 to March 20.
11. Eastern Shore grown seed stored in an unheated basement from November 5 to February 15 and in a heated basement from February 15 to March 18.
12. Garrett County grown seed stored at 40° F. from November 14 to January 15 and at 60° F. from January 15 to March 20.
13. Eastern Shore grown seed stored at 40° F. from November 14 to January 15 and at 60° F. from January 15 to March 20.
14. Eastern Shore grown seed stored in an unheated basement from November 14 to January 15 and at 60° F. from January 15 to March 18.
15. Garrett County grown seed stored at 40° F. from November 14 to February 1 and at 60° F. from February 1 to March 20.
16. Eastern Shore grown seed stored at 40° F. from November 14 to February 1 and at 60° F. from February 1 to March 20.
17. Eastern Shore grown seed stored in an unheated basement from November 5 to February 1 and in a heated basement from February 1 to March 18.

*Typical tubers were selected from 15-pound samples when stored at constant temperatures and from 150-pound samples when stored at temperatures which were not constant.

County, Maryland, it came up and matured just as early as northern-grown Irish Cobbler seed stock. In Garrett County, where the elevation ranges from 2500 to 3000 feet above sea level, the potato crop is planted six to eight weeks later than the early crop on the Maryland Eastern Shore. The writer concluded from these results that late home-grown Eastern Shore seed stock could be made to behave like northern-grown seed stock, if sprout development could be sufficiently stimulated.

TABLE I.

AVERAGE YIELDS FROM NORTHERN-GROWN IRISH COBBLER SEED POTATOES FROM VARIOUS SOURCES*

Seed Source	No. Years Averaged	No. Tests Averaged	Yield in Bu. per Acre**		
			Primes	Culls	Total
Vermont	4	7	228.6	36.2	264.8
South Dakota	6	15	221.0	37.7	258.7
New York	3	11	216.6	38.4	255.0
Michigan	7	13	214.0	41.5	255.5
North Dakota	5	6	210.6	34.6	245.2
Maine	14	32	193.8	36.5	230.3
Minnesota	3	12	192.2	31.3	223.5
Prince Edward Island	10	19	188.0	42.5	230.3
New Brunswick	3	6	180.0	34.6	214.6

*Average from tests conducted on the farms of W. T. Pilchard, Pocomoke; E. E. Nock, Stockton; F. J. Dukes & Bro., Girdletree; and E. T. Taylor, Snow Hill.

**Primes were graded by hand into U. S. No. 1 grade, and the remainder of the crop was classed as culls.

TABLE II.

AVERAGE YIELDS FROM SEED OBTAINED FROM DIFFERENT GROWERS IN THE SAME LOCALITY*

Seed Source	Year	No. Tests Aver.	Germ. Rank	Mat. Rank	Yield in bu. per acre		
					Primes	Culls	Total
Maine Cert. Grower No. 1	1927	3	2	2	360.3	41.5	401.8
Maine Cert. Grower No. 2	1927	3	1.7	1.7	331.5	43.5	375
Maine Cert. Grower No. 3	1927	3	2	2.3	336	32	368
Maine Cert. Grower No. 4	1927	3	2.3	2	129	43	364.3
Maine Cert. Grower No. 4	1928	2	3	2	198.2	38.2	231
Maine Cert. Grower No. 5	1928	2	1	1	199.5	46.5	246
N. Y. Cert. Grower No. 1	1927	3	3.3	3	263.5	38	301.5
N. Y. Cert. Grower No. 2	1927	3	3	3	266.5	30	296.5
N. Y. Cert. Grower No. 1	1928	2	3	2	198	48	246
N. Y. Cert. Grower No. 3	1928	2	1	1	222.8	45.7	268.5
N. J. Cert. Grower No. 1	1927	3	5.3	5.3	286.5	30	316.5
N. J. Cert. Grower No. 2	1927	3	5.6	5.6	216	36	252

*These yields are much above the average yields for Worcester County. This test was conducted on the farm of one of the best potato growers, F. J. Dukes & Bro., Girdletree, in a year which was unusually favorable for potato production.

TABLE III.

AVERAGE YIELDS FROM CERTIFIED AND UNCERTIFIED SEED*

Variety	Seed Source	Yield in Bu. per acre			
		Year	Primes	Culls	Total
Irish Cobbler Certified	Maine	1924	205	36	241
Irish Cobbler Uncertified	Maine	1924	122	109	231
Irish Cobbler Certified	Maine	1925	135	27	162
Irish Cobbler Uncertified	Maine	1925	113	29	142
Irish Cobbler Certified	Maine	1926	171	28	198
Irish Cobbler Uncertified	Maine	1926	164	23	187

*Average from tests conducted on the farms of E. E. Nock, Stockton; F. J. Dukes & Bro., Girdletree; and E. T. Taylor, Snow Hill.

Since raising the storage temperature was considered the most practical method for stimulating sprout development of home-grown seed, storage temperature studies were begun in 1934 and continued to 1939. Late Eastern Shore Irish Cobbler seed stock was used for most of these studies, but, in a few instances, Garrett County Irish Cobbler seed stock was included. The common practice of storing seed potatoes during the winter in unheated basements was compared with other practices which could be expected to stimulate sprout development. Some of the seed potatoes were kept in an unheated basement during the entire storage period, and others were removed at different times to a heated basement where they were kept during the remainder of the storage period. The temperature of the unheated basement was approximately 40° to 45° F., and that of the heated basement, approximately 60° to 65° F. Some of the tubers were also kept in the unheated basement until the early part of March and were then stored in a brooder house, where the temperature was approximately 90° F., until they were planted. Another lot was kept in a sweet potato storage house, where the temperature was approximately 50° to 55° F., during the entire storage period. Different lots of tubers were also stored in compartments, where constant temperatures were maintained. The different compartments were kept at temperatures approximating those of the unheated basement, the heated basement, the brooder house, and the sweet potato storage house, in which the remaining tubers had been stored.*

The late Eastern Shore Irish Cobbler seed stocks which were used in these studies were placed in storage approximately two weeks after they were dug, and the Garrett County seed stocks were placed in storage approximately ten weeks after they were dug. Both Eastern Shore and Garrett County seed stocks were

*Preliminary reports of this work have been published (13, 15, 16). Storage chambers were made available for this work by Dr. D. F. Fisher.

kept in a well-ventilated building from the time they were dug until they were placed in storage. They were taken out of storage about the middle of March and kept in a well-ventilated building until they were planted a week to ten days later. All of the seed stocks which had been subjected to the various storage temperatures were planted on the farm of Willard T. Pilchard, Pocomoke, Maryland.

Effect of Storage Temperature on Sprout Development

The effect of the various storage temperatures upon sprout development was as follows:

1. Maine seed kept in unheated storage houses.
   Apical sprouts ½ to ¾ inch long. Other sprouts very much shorter.
2. Garrett County, Md. seed kept in an unheated basement** from November 5 to March 18.
   Apical sprouts 1 to 1½ inches long. Other sprouts very much shorter.
3. Garrett County, Md. seed kept at 40° F. from November 14 to March 20.
   Very slight sprout development. Apical dominance apparent.
4. Maryland Eastern Shore late crop seed kept in an unheated basement from November 5 to March 18.
   Slight development of apical sprout. Other eyes show almost no sprout development.
5. Maryland Eastern Shore late crop seed kept at 40° F. from November 14 to March 20.
   Buds appear nearly dormant.
6. Garrett County, Md. seed kept at 50° F. from November 14 to March 20.
   Apical sprouts 1 to 1½ inches long. Other eyes show short sprouts.
7. Maryland Eastern Shore late crop seed kept at 50° F. from November 14 to March 20.
   Apical sprout ⅛ to ¼ inch long. Lateral sprouts much shorter.
8. Maryland Eastern Shore late crop seed kept in a sweet potato storage house (approximately 55°) from November 5 to March 17.
   Apical sprout ½ to ¾ inch long. Other buds nearly dormant.

**The temperature of the unheated basement was approximately 40° F. to 45° F.

9. Garrett County, Md. seed kept at 40° F. from November 14 to February 15; then at 60° F. to March 20.
   Apical dominance broken.* Numerous sprouts, most of which were ½ to ¾ inch long.

10. Maryland Eastern Shore late crop seed kept at 40° F. from November 14 to February 15; then at 60° F. to March 20.
    Apical sprout ½ to ¾ inch long. Other eyes have short sprouts.

11. Maryland Eastern Shore late crop seed kept in an unheated basement from November 5 to February 15; then in a heated basement to March 18.†
    Apical sprout ½ to ¾ inch long. Other eyes nearly dormant.

12. Garrett County, Md. seed kept at 40° F. from November 14 to February 1; then at 60° F. to March 20.
    Apical dominance broken. Many sprouts ½ to ¾ inch long. Some shorter.

13. Maryland Eastern Shore late crop seed kept at 40° F. from November 14 to February 1; then at 60° F. to March 20.
    Apical sprout ¼ to ½ inch long. Other sprouts very much shorter.

14. Maryland Eastern Shore late crop seed kept in an unheated basement from November 5 to February 1; then in a heated basement to March 18.
    Apical sprout ½ to ¾ inch long. Other sprouts much shorter.

15. Maryland Eastern Shore late crop seed (3 years) kept in an unheated basement from November 5 to February 1; then in a heated basement to March 18.
    Apical sprout ¼ to ½ inch long. Other sprouts much shorter.

16. Garrett County, Md. seed kept at 40° F. from November 14 to January 15, and at 60° F. to March 20.
    Apical dominance broken. Many sprouts 1 to 1½ inches long. Others shorter.

17. Maryland Eastern Shore late crop seed kept at 40° F. from November 14 to January 15; then at 60° F. to March 20.
    Apical sprout ½ to ¾ inch long. Other sprouts somewhat shorter. Tendency for breaking of apical dominance.

*Definition of apical dominance by Appleman (2) used.
†The temperature of the heated basement was approximately 60° F. to 65° F.

18. Maryland Eastern Shore late crop seed kept in an unheated basement from November 5 to January 15, and then in a heated basement to March 18.
Apical sprout ¾ inch to 1 inch long. Other buds almost dormant.

19. Maryland Eastern Shore late crop seed kept in an unheated basement from November 14 to March 1; then in a brooder house (approximately 90° F.) to March 18.
Apical sprout ½ to ¾ inch long (more spindly than at lower temperatures). Other sprouts shorter.

Effect of Storage Temperature on Plant Development

The variation in size of plants from seed potatoes which had been subjected to the different storage temperatures, when observed two months after planting, was approximately the same from year to year.

FIG. 3

Effect of Storage Temperature on Late Grown Eastern Shore Irish Cobbler Seed Potatoes

Three upper plants grown from late grown Eastern Shore Irish Cobbler potatoes kept in an unheated basement at a temperature of approximately 45° F. from November 16 to March 18.

Three lower plants grown from late grown Eastern Shore Irish Cobbler seed potatoes kept in an unheated basement at a temperature of approximately 45° F. from November 16 to January 15 and in a heated basement at a temperature of approximately 65° F. from January 15 to March 18.

Planted March 26, 1936, photographed May 12, 1936.

In 1937, a typical year in which all of the treatments were compared, plants grown from tubers subjected to the various storage temperatures had the following heights:

2 to 4 inches—Maine seed kept in unheated storage houses.
Garrett County (mountain-grown) seed kept at 50° from November 14 to March 20.

1¾ to 3¾ inches—Garrett County seed kept in an unheated basement from November 5 to March 18.
Garrett County seed kept in a sweet potato storage house from November 5 to March 17.
Garrett County seed kept at 40° F. from November 14 to January 15 and then at 60° F. to March 20.

1½ to 3½ inches—Eastern Shore seed kept at 40° F. from November 14 to January 15 and then at 60° F. to March 20.
Eastern Shore seed kept in an unheated basement from November 2 to March 1 and then in a brooder house to March 18.
Eastern Shore seed kept at 40° F. from November 14 to March 1 and then at 80° F. until March 20.
Eastern Shore seed kept in a sweet potato storage house from November 2 to March 17.

1 to 3 inches—Eastern Shore seed kept in an unheated basement from November 5 to January 15; then in a heated basement to March 18.
Eastern Shore seed kept in an unheated basement from November 5 to February 1; then in a heated basement to March 18.
Eastern Shore seed kept at 40° F. from November 14 to March 1; then at 90° F. to March 20.

½ to 2½ inches—Eastern Shore seed kept at 40° F. from November 14 to February 1, then at 60° F. to March 20.
Eastern Shore seed kept in an unheated basement from November 5 to February 15, then in a heated basement to March 18.
Eastern Shore seed kept in an unheated basement from November 5 to March 18.
Eastern Shore seed kept at 50° F. from November 14 to March 20.

¼ to 1½ inches—Eastern Shore seed kept at 40° F. from November 14 to March 20.

Plants grown from seed potatoes subjected to the various storage temperatures matured in the same order as their relative

size two months after planting. Thus, the plants which were 2 to 4 inches high at that time matured the earliest, and the latest to mature were the plants which were ¼ to 1½ inches high.

Effect of Storage Temperature on Yield

Irish Cobbler potato tubers which had been subjected to the various storage temperatures were planted on the farm of Willard T. Pilchard, Pocomoke, Maryland, during the years 1934,

FIG. 4

Effect of Storage Temperature on Eastern Shore Late Grown Irish Cobbler Seed Potatoes

The two center rows were grown from late Eastern Shore Irish Cobbler seed potatoes kept at a temperature of 40° F. from November 3 to March 18.

The two rows at the left of the center were grown from late Eastern Shore Irish Cobbler seed potatoes kept at a temperature of 40° F. from Nov. 3 to Feb. 1 and at a temperature of 65° F. from February 1 to March 15.

The two rows further to the left were grown from late Eastern Shore Irish Cobbler seed potatoes kept at a temperature of 40° F. from November 3 to March 5, and at a temperature of 80° F. from March 5 to March 18.

The two rows at the right were grown from late Eastern Shore seed potatoes kept in a sweet potato storage house at a temperature of approximately 55° F. from October 19 to March 21.

The two rows further right were grown from late Eastern Shore Irish Cobbler seed potatoes kept in an unheated basement where the temperature was approximately 45° F. from October 19 to February 28 and in a brooder house where the temperature was approximately 90° F. from February 28 to March 18.

The entire field was planted on the same day—March 23, 1938.

to 1938, inclusive. In the accompanying table, yields from these tubers are recorded. It will be noted that each year the largest yield was obtained from tubers which had been subjected to a

TABLE IV.

EFFECT OF STORAGE TEMPERATURE ON YIELD*

The Irish Cobbler variety was used in all of the plots.**

Tubers were graded by hand into primes and culls.

Primes were selected to correspond with grade U. S. No. 1 and culls with a combination of grade U. S. No. 2 and culls.

The temperature of the unheated basement was approximately 40° to 45° F.

The temperature of the heated basement was approximately 60° to 65° F.

The temperature of the sweet potato storage was approximately 50° to 55° F.

The temperature of the brooder house was approximately 90° F.

A. Planted April 11, 1934, harvested July 18, 1934.

Seed Source	Storage Condition	Yield in Bu. per Acre		
		Primes	Culls	Total
Eastern Shore from Maine seed	Unheated basement Nov. 2 to Jan. 15; heated basement Jan. 15 to Mar. 14	245	38	283
North Dakota	Storage condition not known	227	39	266
Eastern Shore from Maine seed	Unheated basement Nov. 2 to Feb. 14; heated basement Jan. 15 to Mar. 14	219	45	264
Eastern Shore from Maine seed	Unheated basement Nov. 2 to Mar. 14	215	28	243
Prince Edward Island	Storage condition not known	210	44	254
Maine	Storage condition not known	175	44	219

*Plots were planted in four replications.

**Replications were each 1/32 acre with the exception of plot D, in which they were only 1/1000 of an acre, due to the limited number of tubers which could be kept at constant storage temperatures.

TABLE IV.—Continued

B. Planted March 19, 1935, harvested July 17, 1935.

Seed Source	Storage Condition	Yield in Bu. per Acre		
		Primes	Culls	Total
Eastern Shore from Prince Edward Island seed	Unheated basement Oct. 31 to Mar. 13	264	47	311
Eastern Shore from Prince Edward Island seed	Unheated basement Oct. 31 to Feb. 15. Heated basement Feb. 15 to Mar. 13	234	73	307
Prince Edward Island	Storage condition not known	190	77	267
Eastern Shore from Prince Edward Island seed	Unheated basement Oct. 31 to Jan. 15. Heated basement Jan. 15 to Mar. 13	182	69	251
Garrett County, Maryland	Ventilated shed Aug. 28 to Oct. 31. Unheated basement Oct. 31 to Mar. 13	176	71	247
Maine	Storage condition not known	145	86	231

TABLE IV.—Continued

C. Planted March 26, 1936, harvested July 7, 1936.

Seed Source	Storage Condition	Yield in Bu. per Acre		
		Primes	Culls	Total
Eastern Shore from Maine	Unheated basement Nov. 5 to Mar. 18	263	22	285
Maine	Storage condition not known	263	13	276
North Dakota	Storage condition not known	260	15	275
Eastern Shore from Maine	Sweet potato storage Nov. 5 to Mar. 17	256	18	274
Garrett County, Maryland	Ventilated shed Aug. 30 to Nov. 5. Unheated basement Nov. 5 to Mar. 18	254	20	274
Eastern Shore from Maine	Unheated basement Nov. 5 to Feb. 1. Heated basement Feb. 1 to Mar. 18	253	23	276
Eastern Shore from Maine	Unheated basement Nov. 5 to Feb. 15. Heated basement Feb. 15 to Mar. 18	252	21	273
Eastern Shore from Maine	Unheated basement Nov. 5 to Mar. 1. Brooder house Mar. 1 to Mar. 18	251	14	265
Eastern Shore from Maine	Unheated basement Nov. 5 to Jan. 15. Heated basement Jan. 15 to Mar. 18	245	27	272

TABLE IV.—Continued

D. Planted April 1, 1936, harvested July 7, 1936.
Garrett County seed dug Aug. 28, 1935, kept in a well-ventilated shed until Nov. 14, then placed in controlled temperature chambers. Eastern Shore seed dug Nov. 4, 1935, kept in cellar until Nov. 14, then placed in controlled temperature chambers. Rest period of Eastern Shore seed broken Jan. 22-27. Rest period of Garrett County seed broken Dec. 5-9.

Seed Source	Storage Condition	Yield in Bu. per Acre		
		Primes	Culls	Total
Eastern Shore from Maine	40° F. Nov. 14 to Jan. 15, 60° F. Jan. 15 to Mar. 20	334	28	362
Eastern Shore from Maine	40° F. Nov. 14 to Feb. 15, 60° F. Feb. 15 to Mar. 20	312	36	348
Eastern Shore from Maine	50° F. Nov. 14 to Mar. 20	293	42	335
Eastern Shore from Maine	40° F. Nov. 14 to Feb. 1, 60° F. Feb. 1 to Mar. 20	275	40	315
Eastern Shore from Maine	40° F. Nov. 14 to Mar. 1, Brooder house (90° F.) to Mar. 18	273	22	295
Garrett County	50° F. Nov. 14 to Mar. 20	248	36	284
Garrett County	40° F. Nov. 14 to Mar. 20	236	44	281
Eastern Shore from Maine	40° F. Nov. 14 to Mar. 20	224	30	254
Garrett County	40° F. Nov. 14 to Feb. 15, 60° F. Feb. 15 to Mar. 20	218	90	308
Garrett County	40° F. Nov. 14 to Feb. 1, 60° F. Feb. 1 to Mar. 20	194	66	260
Garrett County	40° F. Nov. 14 to Jan. 15, 60° F. Jan. 15 to Mar. 20	194	44	248

TABLE IV.—Continued

E. Planted March 31, 1937, harvested July 19, 1937.

Seed Source	Storage Condition	Yield in Bu. per Acre		
		Primes	Culls	Total
Maine	Storage condition not known	229	46	275
Garrett County, Maryland	Ventilated shed Aug. 18 to Nov. 5. Unheated basement Nov. 5 to Mar. 18	214	60	274
Eastern Shore from Garrett County seed	40° F. Nov. 7 to Mar. 5, 80° F. Mar. 5 to Mar. 18	210	59	269
Eastern Shore from Garrett County seed	Unheated basement Nov. 5 to Mar. 1. Brooder house 90° F. Mar. 1 to Mar. 18	209	58	267
Eastern Shore from Garrett County seed	40° F. Nov. 7 to Mar. 5, 90° F. Mar. 5 to Mar. 18	207	59	266
Eastern Shore from Garrett County seed	Unheated basement Nov. 5 to Feb. 15. Heated basement Feb. 15 to Mar. 18	205	52	257
Eastern Shore from Garrett County seed	Unheated basement Nov. 5 to Jan. 15. Heated basement Jan. 15 to Mar. 18	202	52	254
Eastern Shore from Garrett County seed	Unheated basement Nov. 5 to Feb. 1. Heated basement Feb. 1 to Mar. 18	199	52	251
Garrett County, Maryland	40° F. Nov. 7 to Mar. 18	198	66	264
Eastern Shore from Garrett County seed	40° F. Nov. 7 to Feb. 1, 60° F. Feb. 1 to Mar. 18	197	63	260
Garrett County, Maryland	40° F. Nov. 7 to Feb. 15, 60° F. Feb. 15 to Mar. 18	195	63	258
Eastern Shore from Garrett County seed	40° F. Nov. 7 to Jan. 15, 60° F. Jan. 15 to Mar. 18	195	59	254

TABLE IV—Continued

F. Planted March 31, 1937, harvested July 19, 1937.

Seed Source	Storage Condition	Yield in Bu. per Acre		
		Primes	Culls	Total
Eastern Shore from Garret County seed	Sweet potato storage Nov. 5 to Mar. 18	186	53	239
Eastern Shore from Garrett County seed	40° F. Nov. 7 to Feb. 15, 60° F. Feb. 15 to Mar. 18	176	60	236
Garrett County, Maryland	Sweet potato storage Nov. 5 to Mar. 18	170	66	236
Eastern Shore from Garrett County seed	Unheated basement Nov. 5 to Mar. 18	169	47	216
Eastern Shore from Garrett County seed	50° F. Nov. 7 to Mar. 18	161	53	214
Eastern Shore from Garrett County seed	40° F. Nov. 7 to Mar. 18	148	30	178

G. Planted March 23, 1938, harvested July 8, 1938.

Seed Source	Storage Condition	Yield in Bu. per Acre		
		Primes	Culls	Total
Eastern Shore from Maine	Sweet potato storage Oct. 19 to Mar. 22	245	29	274
Eastern Shore from Maine	Unheated basement Oct. 19 to Jan. 15. Heated basement Jan. 15 to Mar. 22	242	31	273
Eastern Shore from Maine	Unheated basement Oct. 19 to Feb. 1. Heated basement Feb. 1 to Mar. 22	236	23	259
Eastern Shore from Maine	Unheated basement Oct. 19 to Mar. 22	235	31	266
Maine	Storage condition not known	234	28	262
Eastern Shore from Maine	Unheated basement Oct. 19 to Feb. 28. Brooder house Feb. 28 to Mar. 22	232	21	253
Eastern Shore from Maine	40° F. Nov. 3 to Mar. 18	218	36	254
Eastern Shore from Maine	Unheated basement Oct. 19 to Feb. 15. Heated basement Feb. 15 to Mar. 22	217	33	250
Eastern Shore from Maine	40° F. Nov. 3 to Mar. 5 80° F. Mar. 5 to Mar. 18	212	40	252
Eastern Shore from Maine	40° F. Nov. 3 to Feb. 1 65° F. Feb. 1 to Mar. 18	200	63	263

different storage temperature. Observations made during the years when the tests were conducted indicate that this apparent inconsistency is probably due to the influence of climatic conditions and soil texture upon the crop. If the early part of the season was dry and rains came late, seed which germinated and matured latest usually yielded best. If, on the other hand, the rains came early and the soil dried out during the latter part of the growing season, the seed which emerged and matured earliest gave the largest yield. Yields from the early emerging and maturing seed were also found to be the largest in soils which had good water-retaining capacity. Former studies by the writer and Oswald (14) indicate that on the Eastern Shore of Maryland larger yields can usually be expected from Irish Cobbler seed stocks which germinate and mature the earliest. The following weather conditions were observed in Worcester County, Maryland, from 1934 to 1938 inclusive:

In 1934 the months of April and May were cool on the Eastern Shore, and the rainfall was adequate for the potato crop. Hot and dry weather prevailed during the months of June and July. The largest yields were obtained from the Eastern Shore late crop seed which was warmed on the 15th of January until planting time (245 bu. prime potatoes to the acre) and the next largest yield (227 bu. prime potatoes to each acre) from North Dakota seed. The yield from Eastern Shore late crop seed which was kept in an unheated basement during the entire storage period was only 215 bushels of prime potatoes per acre. This seed germinated and matured ten days later than the North Dakota seed stock and the home-grown Eastern Shore seed which had received the warming-up treatment.

In 1935 April and May were very dry, but sufficient rain fell in June and July to benefit the potato crop. The yield from the Eastern Shore late crop seed which was kept in an unheated basement during the entire storage period was 264 bushels of prime potatoes per acre. The yield from the same seed warmed up from the 15th of January until planting time was only 182 bushels of prime potatoes per acre. The yield from Maine seed which germinated at the same time as the warmed seed was 145 bushels of prime potatoes per acre.

The season in 1936 was very similar to that of 1935. On the same type of land; i. e., land which does not retain moisture, results were very similar in 1935 and 1936. The yield from the Eastern Shore seed kept in an unheated basement during the entire storage period was 263 bushels of prime potatoes per acre, and the yield from the same seed stock warmed from the 15th of January until planting time was only 245 bushels of prime potatoes per acre.

During this season an additional test plot was planted in an

adjacent field on the farm of W. T. Pilchard at Pocomoke with seed kept at controlled storage temperatures. The soil in this field retained more moisture than the soil in the other test plots. The yield from the Eastern Shore seed kept at a constant temperature of 40° F. from the 14th of November to the 15th of January, and 60° F. from the 15th of January to the 20th of March, was 334 bushels of prime potatoes. The yield from the same seed kept at a constant temperature of 40° F. from the 14th of November to the 20th of March was only 224 bushels per acre of prime potatoes.

The yield from the mountain-grown Garrett County seed kept at a constant temperature of 50° F. from the 14th of November to the 20th of March was 248 bushels of prime potatoes per acre. The yield from the same seed kept at a constant temperature of 40° F. from the 14th of November to the 20th of March was 236 bushels per acre of prime potatoes. The yield from the same seed kept at 40° F. from the 14th of November to the 1st of February, and at 60° F. from this date until the 20th of March, was 194 bushels per acre of prime potatoes. For further details see accompanying tables.

The season of 1937 was very similar to that of 1934 on the Maryland Eastern Shore, and it will be noted that results were also similar. The largest yields were obtained from seed which came up and matured earliest, Maine seed (235 bu. primes and 43 bu. culls per acre), Garrett county seed (214 bu. primes and 60 bu. culls per acre), and Eastern Shore seed kept at 40° F. November 7 to March 5 and at 80° F. March 5 to March 18 (219 bu. primes and 59 bu. culls per acre). The smallest yields were obtained from seed which came up and matured latest, Eastern Shore seed kept at 40° F. November 7 to March 18 (148 bu. primes and 30 bu. culls per acre).

During the season of 1938, the rainfall was ample for production of the potato crop, and there was little difference in yield between plots grown from potato tubers stored at different temperatures.

Results of Other Investigators

Bushnell (6) compared Ohio late-grown Irish Cobbler seed potatoes kept at approximately 40° F. during the entire storage period with the same seed kept at approximately 40° F. until the 1st of March and then kept at 68° F. until planted. In 1935, the warmed seed yielded 402.5 bushels of large potatoes to the acre, whereas similar seed kept at ordinary storage temperature during the entire storage period yielded 329.6 bushels. The warmed Ohio late-grown potatoes yielded more than the samples of Cobblers obtained from New York and Maine. In

1936, the warmed Ohio late crop Irish Cobbler seed potatoes yielded 102.4 bushels of large potatoes to the acre compared with a yield of 84.5 bushels to the acre of large potatoes from similar seed kept in ordinary storage during the entire storage period. Some of the Maine, New York, and Minnesota samples yielded more than the Ohio warmed late crop seed, but the yield from the Ohio warmed late crop seed was greater than the average yield from all Cobblers tested (average yield of all Irish Cobblers tested, 83.8 bushels of large potatoes to the acre).

In tests conducted in two different places in Louisiana, Miller, Kimbrough, and Richards (23) obtained higher yields from home-grown seed kept at high temperatures than they did from home-grown seed kept at lower temperatures. Their conclusion was that "if fall potatoes can be stored at higher temperatures, their value for seed will be greatly increased." Smith (27) also found that higher storage temperatures of seed potatoes hastened the coming and maturity of the vines and increased the yield.

Effect of Storage Temperature on Susceptibility to Disease

Disease readings that were made in all of the plots grown from Irish Cobbler seed stock kept at various storage temperatures failed to show any significant differences in the percentage of plants infected with virus diseases.

PRODUCTION OF A LATE SEED CROP

In order to determine the best practices for production of a healthy seed potato crop on the Maryland Eastern Shore, a late potato plot was planted each year on the farm of Willard T. Pilchard, Pocomoke, Maryland, beginning in 1932 and continuing to 1939. The Irish Cobbler and other early varieties were planted early in August, and later varieties were planted about the middle of July. The field was usually harvested early in November, and yield records were secured (see Table V). The largest yields were obtained from late varieties, the next largest yields from medium late varieties, and the smallest yields from early varieties. Of the late varieties, the largest yields were obtained from the McCormicks and Dakota Reds, and the poorest yields were obtained from the Rurals. The Green Mountain gave a satisfactory yield in 1932, the only year it was included. There was little difference in yield between seed stocks of Irish Cobbler potatoes obtained from various sources. In Garrett County,

TABLE V

YIELD RECORDS FROM LATE POTATO PLOTS
GROWN ON THE FARM OF WILLARD T. PILCHARD, POCOMOKE, MD.*

Variety	Seed Source	Yield in Bu. per Acre		
		U. S. No. 1 and No. 2	Culls	Total
	1932—Early Varieties			
Irish Cobbler	Maine	79.2	13.5	92.7
Irish Cobbler	Prince Edward Island	79.0	12.5	91.5
Irish Cobbler	North Dakota	78.7	13.5	92.2
Irish Cobbler	Md. Eastern Shore 2 yrs. from Mich.	74.0	15.0	89.0
Irish Cobbler	Michigan	54.0	11.3	65.3
	1932—Late and Medium Late Varieties			
White McCormick	Maryland Eastern Shore	204.5	10.1	214.6
Dakota Red	Maryland Eastern Shore	140.0	25.7	165.7
Green Mountain	Maine	138.1	25.0	163.1
Katahdin	Maine	126.0	12.5	138.5
Smooth Rural (Mason)	Md., Garrett Co.	98.7	12.8	111.5
Russet Rural	Md., Garrett Co.	83.6	15.2	98.8
	1934—Early Varieties			
Irish Cobbler	Maine	34	25	59
Irish Cobbler	Md. Eastern Shore from Mich. seed	26	22	48
Irish Cobbler	Md. Eastern Shore from Gar. Co. seed	26	22	48
	1934—Late and Medium Late Varieties			
White McCormick	Md. Eastern Shore	112	8	120
Dakota Red	Md. Eastern Shore	95	17	112
Chippewa	Maine	64	12	76
Katahdin	Md. Eastern Shore	61	3	64

*Severe storms killed all potato plants prematurely in the late potato plots in 1933 and 1938, and no yield records were obtained.

TABLE V—Continued

Variety	Seed Source	Yield in Bu. per Acre		
		U. S. No. 1 and No. 2	Culls	Total
	1935—*Early Varieties*			
Irish Cobbler	Maine	111	14	125
Irish Cobbler	Gar. Co., Md.	98	15	113
Irish Cobbler	Md. Eastern Shore	66	18	84
	1935—*Late and Medium Late Varieties*			
Dakota Red	Md. Eastern Shore	189	15	214
McCormick	Md. Eastern Shore	192	7	199
Katahdin	Md. Eastern Shore	166	24	190
Green Mountain	Md., Gar. Co.	161	23	184
Smooth Rural (Mason)	Md., Gar. Co.	111	12	123
Chippewa	Md., Gar. Co.	101	12	113
Russet Rural	Md., Gar. Co.	82	7	89
	1936—*Early Varieties*			
Irish Cobbler	Md. Eastern Shore	52	17	69
Irish Cobbler	Md., Gar. Co.	49	15	64
Warba	Md., Gar. Co.	45	7	52
Irish Cobbler	South Dakota	26	6	32
	1936—*Medium Late Varieties*			
Katahdin	Md., Gar. Co.	70	12	82
Chippewa	Md., Gar. Co.	51	9	60
	1937—*Early Varieties*			
Warba	Md., Gar. Co.	42	35	77
Irish Cobbler	Md., Gar. Co.	36	38	74
Irish Cobbler	Maine	30	29	59
	1937—*Late and Medium Late Varieties*			
Dakota Red	Md. Eastern Shore	77	28	105
Smooth Rural (Mason)	Md., Gar Co.	45	14	59
Russet Rural	Md., Gar. Co.	32	20	52

where the elevation is 2500 to 3000 feet above sea level, Eastern Shore seed stocks were compared with identical seed stocks from Garrett County. Comparative yield records and disease readings were obtained (see tables VI and VII). The late crop Eastern Shore seed stock yielded just as well or better than identical seed stock grown in Garrett County and elsewhere, but seed stock grown on the Eastern Shore developed more leaf roll and rugose mosaic than identical seed stock grown in Garrett County. On account of this tendency of late Eastern Shore seed stock to develop virus diseases, growers of such seed stock are advised to purchase new seed stock every year, rather than attempt to keep their own seed stock over from year to year. Registered seed should be used, if possible. If registered seed cannot be

obtained, only certified seed grown by the most reliable growers in fields which were practically free from virus diseases should be planted. The result of the failure of many Eastern Shore seed potato growers to exercise these precautions was strikingly illustrated in 1938 when approximately 20% of the acreage of Irish Cobbler potatoes which were entered for certification were disqualified because of the presence of too much leaf roll in the fields. Practically all of these disqualified fields were grown from northern certified seed purchased without knowledge of disease readings.

USE OF EARLY CROP FOR PLANTING THE LATE CROP

At the present time, the late Eastern Shore seed potato crop is grown from seed produced during the preceding year, which has been kept in cold storage during the summer. Although costly and troublesome, this practice has proved successful in the production of late Irish Cobbler seed potato crops for many years. The use of early-grown potatoes for production of the late crop would involve less expense and trouble, but it has not been practical because the plants come up so late that the vines are usually killed by frost before tubers are produced. The

TABLE VI

AVERAGE YIELDS FROM IDENTICAL EASTERN SHORE AND GARRETT COUNTY SEED STOCK GROWN IN GARRETT COUNTY IN 1933, 1935, 1936, 1937, AND 1938*

Variety	Seed Source	No. Yrs. Av.	Yield in Bu. per Acre			
			U. S. No. 1	U. S. No. 2	Culls	Total
Early and Medium Late Varieties						
Irish Cobbler	Eastern Shore	5	207	29	8	244
Irish Cobbler	Garrett County	5	176	33	10	219
Warba	Eastern Shore	2	212	29	4	245
Warba	Garrett County	3	200	26	6	232
Katahdin	Garrett County	4	220	27	7	254
Katahdin	Eastern Shore	3	177	19	4	200
Late Varieties						
Smooth Rural (Mason)	Eastern Shore	5	319	24	8	351
Smooth Rural (Mason)	Garrett County	5	316	30	12	358
Russet Rural	Garrett County	5	300	28	10	338
Russet Rural	Michigan	4	300	24	13	337
Russet Rural	Eastern Shore	3	279	28	9	316

*Average from tests conducted on the farms of William S. Friend and William P. DeBerry, Oakland, Maryland. These tests were conducted in plots containing four replications from which all diseased plants were removed. The yield records were obtained from healthy plants only.

TABLE VII

PERCENTAGES OF LEAF ROLL AND MOSAIC FOUND IN POTATO PLOTS GROWN IN GARRETT COUNTY (ELEVATION 3000 FT.) FROM IDENTICAL SEED STOCK GROWN THE PRECEDING YEAR ON THE EASTERN SHORE AND IN GARRETT COUNTY*

Variety	Seed Source	Year	% Diseased	
			Leaf Roll	Rugose Mosaic
Irish Cobbler	Garrett County	1935	0.0	0.0
Irish Cobbler	Eastern Shore	1935	0.9	2.0
Chippewa	Garrett County	1935	0.9	1.3
Chippewa	Eastern Shore	1935	31.2	0.0
Bliss Triumph	Garrett County	1935	0.0	0.9
Bliss Triumph	Eastern Shore	1935	1.8	4.0
Irish Cobbler	Garrett County	1936	2.9	0.9
Irish Cobbler	Eastern Shore	1936	1.7	0.9
Chippewa	Garrett County	1936	1.3	0.0
Chippewa	Eastern Shore	1936	96.1	0.0
Warba	Garrett County	1937	0.8	0.0
Warba	Eastern Shore	1937	2.6	0.3
Chippewa	Garrett County	1937	14.6	0.0
Chippewa	Eastern Shore	1937	62.5	0.0
Irish Cobbler	Garrett County	1938	1.0	0.0
Irish Cobbler	Eastern Shore	1938	2.3	0.0

reason for this delay in the germination of early-grown potatoes, when they are planted for the production of the late crop, is the fact that all potatoes pass through a rest period after they are dug, and they will not sprout until this rest period is over, even when they are kept under favorable growing conditions. The length of the rest period has been found to vary with different varieties.

Thus, there appear to be two possible methods for using the early potato crop to plant the late seed crop. One is the production or location of a satisfactory variety with a very short rest period, and the other is finding, or producing, a suitable variety which will respond to a practical method for shortening the rest period. The latter has the better possibilities, since several methods for shortening the rest period of potato tubers have already been found.

*On the Eastern Shore the plots were grown on the farm of Willard T. Pilchard, Pocomoke, Maryland, and in Garrett County they were grown on the farm of William P. DeBerry, Oakland, Maryland.

Garrett County and Eastern Shore Rurals had practically no leaf roll or rugose mosaic.

FIG. 5

Four rows at left, Earlaine potatoes grown from seed of spring grown crop treated with Sodium Thiocyanate. Adjacent four rows at left, late crop Irish Cobbler potatoes from seed of spring crop treated with Sodium Thiocyanate. Four rows at right, late crop Warba potatoes grown from seed of spring crop treated with Sodium Thiocyanate. Adjacent four rows at right, late crop Irish Cobbler potatoes grown from stored Maine seed

Treated seed planted July 27, 1937.
Stored seed planted August 4, 1937.

The first successful method for shortening the rest period of potatoes was reported by McCallum (25) in 1909. Other investigators who have reported successful methods are Appleman (2), Rosa (26), Miller-Thurgau (24), Loomis (22), Thornton (29) and Denny (10). These methods include the use of chemicals, heat, cold, and the removal of skin from around the eyes. Only one of these methods, the sodium thiocyanate treatment reported by Denny (10) and studied further by Stuart and Milstead (28), appears to have practical possibilities for commercial potato production in Maryland. The sodium thiocyanate treatment consists in soaking the cut tubers for one hour in a solution of sodium thiocyanate (1 pound of sodium thiocyanate dissolved in 12 gallons of water) and planting immediately.

Studies with the use of spring-grown seed potatoes treated with sodium thiocyanate to shorten the rest period for planting the late potato crop were begun in 1932 and have been continued to the present time.* These studies included the effect of the treatment upon yield, stand, vitality, and seed maintenance. Comparative yield and stand records were secured. Comparative stands obtained from treated spring-grown seed and from seed produced the previous season and kept in cold storage during

*Preliminary reports of these studies have been published (19, 20).

the summer were practically the same from year to year. The average stand obtained from stored seed of all varieties was approximately 85%, and from treated, spring-grown seed it was 85% for the Warba variety, 75% for the Katahdin and Chippewa varieties, and 50% for the Irish Cobbler, Earlaine, and Bliss Triumph varieties.

Not only was there a difference in stand between stored and treated spring-grown seed, but there was also a difference in the rate of germination. The treated spring-grown seed and stored seed of the Warba variety and the stored seed of all the other varieties came up at approximately the same time, but the spring-grown seed of all the other varieties came up unevenly, so that, when the largest plants were six inches high, other plants were just coming through the ground. The average yields obtained from Irish Cobbler, Warba, Chippewa, and Katahdin varieties are indicated in Table VIII. It will be noted that the average yield from the spring-grown, treated Warba seed was larger than the average yield from stored Warba seed, but that with other varieties the reverse was true. These results indicate that seed stock of the Warba variety can be grown successfully from treated, spring-grown seed on the Maryland Eastern Shore, but that poorer stands and yields will probably result from the use of treated, spring-grown seed of other varieties.

If treated, spring-grown seed is to be used for planting the late potato crop, it is essential to know whether it will be necessary to renew the seed stock, and, if it is necessary, how often it must be renewed. In order to determine these facts, a comparison was made between seed stocks grown from stored seed renewed each year and seed stocks where two crops were grown in the same season from the same stock one and two successive years. Seed of the Warba variety grown on the Maryland Eastern Shore was used. The tests were conducted in 1937 and 1938 in Garrett County, because masking of virus diseases is less prevalent there, and disease readings can be made more accurately.

TABLE VIII.

RESULTS OF COMPARATIVE TESTS WITH THE USE OF SPRING-GROWN SEED AND STORED SEED FOR PLANTING THE LATE SEED POTATO CROP ON THE FARM OF WILLARD T. PILCHARD, POCOMOKE, MD., 1932-1937 INCL.*

Variety	Source and Treatment	% Stand†	Yield in Bu. per Acre					
			Actual Yield			Yield Based on 100% Stand		
			U. S. No. 1 and No. 2	Culls	Total	U. S. No. 1 and No. 2	Culls	Total
		1932						
Irish Cobbler	Eastern Shore (fall stored)‡	90	74	15	89	80	17	97
Irish Cobbler	Eastern Shore (spring treated)§	30	16	12	28	53	40	93
Katahdin	Maine (stored)	95	126	13	139	132	15	147
Katahdin	Eastern Shore (spring treated)	75	72	10	82	96	13	109
		1934						
Irish Cobbler	Maine (stored)	90	34	25	59	36	28	64
Irish Cobbler	Eastern Shore (spring treated)	35	10	6	16	29	17	46
Chippewa	Maine (stored)	95	64	12	76	67	13	80
Chippewa	Eastern Shore (spring treated)	75	14	4	18	18	5	23
Katahdin	Eastern Shore (fall stored)	95	61	3	64	64	3	67
Katahdin	Eastern Shore (spring treated)	75	40	2	42	53	3	56
Katahdin	Eastern Shore (spring treated) 6th consec. crop	75	41	4	45	55	5	60
Green Mountain	Eastern Shore (spring treated)	60	37	3	40	62	5	67
		1935						
Irish Cobbler	Maine (stored)	95	111	14	125	117	15	132
Irish Cobbler	Eastern Shore (spring treated)	40	45	.....	45	112	.....	112
Chippewa	Garrett Co. (stored)	90	101	12	113	112	13	125
Chippewa	Eastern Shore (spring treated)	75	41	3	44	55	4	59

*Owing to severe storms no records could be obtained from tests conducted in 1933.

‡Per cent stand estimated in 1932, 1934 and 1935.

§Seed potatoes were stored in an unheated basement from the time they were dug until early April, when they were placed in cold storage and kept there until a few days before planting.

†The cut spring-grown seed was soaked for one hour in a solution of sodium thiocyanate (1 pound sodium thiocyanate crystals dissolved in 12 gallons of water).

TABLE VIII—Continued

Variety	Source and Treatment	% Stand	Yield in Bu. per Acre					
			Actual Yield			Yield Based on 100% Stand		
			U. S. No. 1 and No. 2	Culls	Total	U. S. No. 1 and No. 2	Culls	Total
		1935—Continued						
Chippewa	Eastern Shore (spring untreated)	65	16	12	28	25	18	43
Katahdin	Eastern Shore (fall stored)	90	166	24	190	184	26	210
Katahdin	Eastern Shore (spring treated)	75	55	6	61	73	8	81
Katahdin	Eastern Shore (spring treated) 8th consec. crop	65	32	7	39	50	11	66
Katahdin	Eastern Shore (spring untreated)	65	21	.....	21	32	.....	32
		1936						
Warba	Eastern Shore (spring treated)	91	79	29	108	87	32	119
Warba	Garrett County (stored)	95	45	8	52	47	7	55
Katahdin	Garrett County (stored)	77	70	12	82	91	16	107
Katahdin	Eastern Shore (spring treated)	58	16	4	20	27	7	34
Chippewa	Garrett County (stored)	64	51	9	60	80	14	94
Chippewa	Eastern Shore (spring treated)	56	19	7	26	34	13	46
Irish Cobbler	Garrett County (stored)	98	49	15	64	50	15	65
Irish Cobbler	Eastern Shore (spring treated)	74	21	7	28	28	9	37
Irish Cobbler	Eastern Shore (spring treated) 1½ hours	77	28	5	33	37	7	44

TABLE VIII—Continued

Variety	Source and Treatment	% Stand	Yield in Bu. per Acre					
			Actual Yield			Yield Based on 100% Stand		
			U. S. No. 1 and No. 2	Culls	Total	U. S. No. 1 and No. 2	Culls	Total
		1937						
Warba	Eastern Shore (spring treated) Aug. 4.* 4th consec. crop	51	135	65	200	249	127	376
Warba	Eastern Shore (spring treated) Aug. 4. 2nd consec. crop	52	70	47	117	137	92	229
Warba	Eastern Shore (spring treated) July 27	90	55	36	91	61	40	101
Warba	Garrett County (stored)	85	42	35	77	51	44	95
Earlaine	Eastern Shore (spring treated) Aug. 4	19	36	20	56	189	100	289
Earlaine	Eastern Shore (spring treated) July 27	50	34	13	46	68	26	94
Irish Cobbler	Maine (stored)	85	30	29	59	35	34	69
Irish Cobbler	Eastern Shore (spring treated) July 27	25	23	22	55	92	88	180

*Date planted.

In plots produced from late Eastern Shore seed which had been grown from stored tubers, 2.6% of the plants had leaf roll in 1937, and 1.5% of the plants had leaf roll in 1938. In plots produced from late Eastern Shore seed which had been grown from spring-grown, treated seed, 4.1% of the plants had leaf roll in 1937, and 5.6% of the plants had leaf roll in 1938. In plots produced from late Eastern Shore seed which had been grown from treated, spring-grown seed two successive years, 33% of the plants had leaf roll in 1938.

FIG. 6

Spread of leaf roll in Eastern Shore Chippewa seed stock. In 1935, Chippewa seed stock grown in a tuber unit seed plot in Garrett County (elevation approximately 3000 feet) was divided into two parts. One part was planted on the Eastern Shore at Pocomoke, and the other part was planted at Oakland, Maryland. Both plots were rogued carefully for virus diseases. In the two rows at the left grown from the Eastern Shore stock, 96.1% of the plants had leaf roll. In the two rows at the right grown from the Garrett County stock, only 1.3% of the plants had leaf roll.

These results indicate that it will be very difficult, if not impossible, to maintain satisfactory seed stock of the Warba variety when treated, spring-grown seed is used to produce the late crop and this crop is again used to produce the early crop the following spring, etc. If this method is to be used successfully, it will be necessary to purchase seed of the best quality, preferably registered certified seed, or at least certified seed with very small disease readings, every year for the production of the early crop. It will also be necessary to rogue carefully the portion of the field from which the seed for the late crop is to be saved. If too much disease develops with this method, it may even be necessary to plant the portion of the early crop which is to be used for seed in tuber units.*

If treated, spring-grown seed is to be used in the production of seed stock, it is important to know whether the treatment has any effect on the vitality of the seed stock. In order to get this information, yields were compared in early Eastern Shore

*The tuber unit method of planting seed potatoes has been described by the writer and Heuberger (17).

potato plots† with tubers grown from spring-grown seed stock which had been subjected to the sodium thiocyanate treatment from one to five successive years. The results of these studies, given in Table IX, indicate that the treatment has no detrimental

TABLE IX

AVERAGE OF COMPARATIVE YIELDS FROM TESTS WITH SPRING-GROWN TREATED AND STORED SEED POTATOES PRODUCED AS A LATE CROP ON FARM OF WILLARD T. PILCHARD, POCOMOKE, MD., 1932-1937*

Variety	Source and Treatment	Years Averaged	Yield in Bu. per Acre					
			Actual Yield			Yield Based on 100% Stand		
			Primes†	Culls†	Total	Primes†	Culls†	Total
Warba	Spring treated‡	1936-37	107	47	154	193	73	266
Warba	Stored§	1936-37	44	21	65	52	25	77
Kathdin	Spring treated	1932-35	56	6	62	75	8	83
Kathdin	Stored	1932-36	106	13	119	125	15	140
Chippewa	Spring treated	1934-36	25	5	30	38	8	46
Chippewa	Stored	1934-36	72	11	83	86	13	99
Irish Cobbler	Spring treated	1932-37	23	9	32	63	31	94
Irish Cobbler	Stored	1932-37	60	20	80	64	22	86

*Owing to severe storms no yield records were obtained in 1933 and 1938.

†Primes were selected to correspond with grade U. S. No. 1 and culls with a combination of grade U. S. No. 2 and culls.

‡The cut tubers were soaked for one hour in a solution of sodium thiocyanate (1 pound in 12 gallons of water). They were planted immediately after treatment.

§Seed potatoes were stored in an unheated basement from the time they were dug until early April, when they were placed in cold storage and kept there until a few days before planting.

effect on the vitality of the seed stock. Yields were also computed in 1938 in Garrett County from Eastern Shore seed stock grown from stored seed and from Eastern Shore seed stock grown from treated, spring-grown seed. The Warba variety was used; the field was planted in tuber units in four replications, each 1/67 of an acre. All diseased plants were removed, and the yields were computed from healthy plants only. The yield in bushels per acre from the plot grown from Eastern Shore seed stock produced from stored seed was 283 bushels of U. S. No. 1 potatoes, 30 bushels of U. S. No. 2 potatoes, and 5 bushels of cull potatoes; and from the Eastern Shore seed stock grown from treated seed it was 283 bushels per acre of U. S. No. 1 potatoes, 23 bushels of U. S. No. 2 potatoes, and 3 bushels of cull potatoes. These results also indicate that the treatment has no detrimental effect on the vitality of the seed stock.

Since the Irish Cobbler, the most extensively grown early variety on the Eastern Shore, has not yielded to the sodium thio-

†Farm of Willard T. Pilchard, Pocomoke, Maryland.

cyanate treatment as successfully as the Warba variety, an effort was made to determine whether lengthening the time the seed was soaked in the solution would improve its response to the treatment. In 1936, plots grown on the Eastern Shore from spring-grown Irish Cobbler seed potatoes treated for one hour were compared with plots grown from Irish Cobbler seed potatoes treated for one and one-half hours. There was no significant difference in the stand and yield in the plots grown from spring-grown Irish Cobbler potatoes subjected to the different treatments, the stand being approximately 50% in both cases, and the yield of primes per acre from spring-grown seed treated for one hour being 21 bushels and from spring-grown seed treated for one and one-half hours 28 bushels.

An effort was made also to determine whether any early potato seedlings could be found which would respond to the sodium thiocyanate treatment as well as, or better than, the Warba variety. In 1938, spring-grown seed of thirty-three different potato seedlings obtained from the United States Department of Agriculture* were treated for one hour with a sodium thiocyanate solution and planted for a late crop on the Eastern Shore at Pocomoke, Maryland.† Six of these seedlings came up just as soon with just as good a stand as treated Warba seed planted in the same plot. These studies are being continued.

POTATO VARIETIES STUDIES‡

For many years, almost no other variety than the Irish Cobbler has been used for planting the early table stock and late seed potato crop on the Maryland Eastern Shore. Its popularity has been due chiefly to its excellent marketing and cooking qualities, its resistance to mild mosaic, and to the availability of desirable seed stock at reasonable prices. Recently, there has developed a desire on the part of many Eastern Shore potato growers for varieties which have even better qualities than the Irish Cobbler and which will give better yields and be more resistant to diseases, especially to late blight and scab. In 1932, comparative studies between Irish Cobbler and other potato varieties were begun, and they have been continued to the present time. Yield records of varieties which have been compared with the Irish Cobbler will be found in Tables X and XI. Results are summarized as follows:

Irish Cobbler. The Irish Cobbler is either immune or highly resistant to mild mosaic under field conditions in Maryland. No

*Through the courtesy of F. J. Stevenson and C. F. Clark, Division of Fruit and Vegetable Crops and Diseases, Bureau of Plant Industry, U. S. Department of Agriculture.

†Farm of Willard T. Pilchard, Pocomoke, Maryland.

‡A preliminary report of the behavior of disease-resistant potato varieties in Maryland has been published by the writer (13).

typical case has ever been found in any seed stock which has been observed in Maryland, even in seed stock grown adjacent to Green Mountains in which mild mosaic was prevalent. It has

TABLE X.

EFFECT OF SODIUM THIOCYANATE TREATMENT ON VITALITY OF SEED. COMPARATIVE YIELDS FROM TREATED AND UNTREATED SEED STOCK IN THE EARLY POTATO CROP ON THE FARM OF WILLARD T. PILCHARD, POCOMOKE, MD.

Variety	Seed Source and Treatment	Year	Yield in Bu. per Acre		
			Primes	Culls	Total
Katahdin	Eastern Shore (spring treated*)	1933	200	22	222
Katahdin	Eastern Shore (fall stored†)	1933	199	20	219
Katahdin	Eastern Shore (spring treated) 2 successive years	1934	202	28	230
Katahdin	Eastern Shore (fall stored)	1934	180	18	198
Katahdin	Eastern Shore (fall stored)	1935	203	34	237
Katahdin	Eastern Shore (spring treated)	1935	201	23	224
Katahdin	Eastern Shore (spring treated) 3 successive years	1935	184	28	212
Katahdin	Eastern Shore (spring treated)	1936	275	17	289
Katahdin	Eastern Shore (fall stored)	1936	240	29	269
Katahdin	Eastern Shore (spring treated) 4 successive years	1936	233	16	249
Warba	Eastern Shore (fall stored)	1937	235	43	278
Warba	Eastern Shore (spring treated)	1937	227	47	274
Warba	Eastern Shore (fall stored)	1938	285	24	309
Warba	Eastern Shore (spring treated)	1938	276	29	305
Warba	Eastern Shore (spring treated) 2 successive years	1938	245	29	274

*The cut spring-grown seed was soaked for 1 hour in a solution of sodium thiocyanate (1 pound in 12½ gallons of water) and planted immediately.

†Seed potatoes were stored in an unheated basement from the time they were dug until early April, when they were placed in cold storage and kept there until a few days before planting.

TABLE XI.

YIELDS FROM IRISH COBBLER SEED POTATOES COMPARED WITH YIELDS FROM OTHER EARLY AND MEDIUM LATE VARIETIES IN THE EARLY POTATO CROP ON THE FARM OF WILLARD T. PILCHARD, POCOMOKE, MD.*

Variety and Seed Source	Year	Yield in Bu. per Acre			Variety and Seed Source	Yield in Bu. per Acre		
		Primes	Culls	Total		Primes	Culls	Total
Bliss Triumph, Gar. Co., Md.	1938	211	45	256	Irish Cobbler, Gar. Co., Md.	151	32	183
Chippewa, Gar. Co., Md.	1935	176	39	215	Irish Cobbler, Gar. Co., Md.	176	71	247
Chippewa, Gar. Co., Md.	1936	220	20	240	Irish Cobbler, Gar. Co., Md.	254	16	270
Chippewa, Gar. Co., Md.	1937	271	68	339	Irish Cobbler, Gar. Co., Md.	229	46	275
Chippewa, Gar. Co., Md.	1938	207	27	234	Irish Cobbler, Gar. Co., Md.	151	32	183
Chippewa, Gar. Co., Md.	1939	38	12	50	Irish Cobbler, Gar. Co., Md.	99	56	155
Chippewa Average		181	33	214	Irish Cobbler Average	182	44	226
Earlaine, Maine	1937	209	59	268	Irish Cobbler, Maine	229	46	275
Earlaine, Eastern Shore, Md.	1938	235	28	242	Irish Cobbler, E. Shore, Md.	242	25	267
Earlaine Average		222	44	266	Irish Cobbler Average	235	35	270
Houma, Maine	1937	88	87	175	Irish Cobbler, Maine	229	46	275
Katahdin, Maine	1932	248	32	280	Irish Cobbler, Maine	181	35	216
Katahdin, Maine	1933	203	42	245	Irish Cobbler, Maine	190	50	240
Katahdin, Maine	1934	208	36	244	Irish Cobbler, Maine	175	44	219
Katahdin, Gar. Co., Md.	1935	255	52	307	Irish Cobbler, Gar. Co., Md.	176	71	247
Katahdin, Gar. Co., Md.	1936	236	30	266	Irish Cobbler, Gar. Co., Md.	254	20	274
Katahdin, Maine	1937	205	37	242	Irish Cobbler, Maine	229	46	275
Katahdin, Gar. Co., Md.	1938	227	24	251	Irish Cobbler, Gar. Co., Md.	151	45	196
Katahdin, Gar. Co., Md.	1939	100	23	123	Irish Cobbler, Gar. Co., Md.	98	56	154
Katahdin Average		210	32	242	Irish Cobbler Average	181	45	226
Nittany Cobbler, Gar. Co., Md.	1937	199	48	147	Irish Cobbler, Gar. Co., Md.	229	46	275
Nittany Cobbler, Gar. Co., Md.	1938	201	64	265	Irish Cobbler, Gar. Co., Md.	151	32	183
Nittany Cobbler Average		200	56	256	Irish Cobbler Average	190	39	229
Warba, Gar. Co., Md.	1936	247	36	310	Irish Cobbler, Gar. Co., Md.	254	20	274
Warba, Eastern Shore, Md.	1937	235	43	278	Irish Cobbler, E. Shore, Md.	210	59	269
Warba, Eastern Shore, Md.	1938	285	24	309	Irish Cobbler, E. Shore, Md.	242	31	273
Warba, Eastern Shore, Md.	1939	85	62	147	Irish Cobbler, E. Shore, Md.	92	48	140
Warba Average		220	41	261	Irish Cobbler Average	200	40	240
White Rose, Gar. Co., Md.†	1938	158	60	218	Irish Cobbler, Gar. Co., Md.	151	45	196

*Yield records obtained by averaging the yield from four replications, each 1/40 acre.

†The quality of the White Rose potatoes was very poor in 1938. In 1939 the yield from the White Rose variety was so poor that it was not recorded.

TABLE XII.

YIELDS FROM IRISH COBBLER SEED POTATOES COMPARED WITH YIELDS FROM OTHER EARLY AND MEDIUM LATE VARIETIES IN LATE CROP ON THE FARM OF WILLARD T. PILCHARD, POCOMOKE, MD.

Variety and Seed Source	Year	Yield in Bu. per Acre		
		U. S. No. 1 and No. 2	Culls	Total
Chippewa, Maine	1934	64	12	76
Chippewa, Gar. Co., Md.	1935	101	12	113
Chippewa, Gar. Co., Md.	1936	51	9	60
Chippewa, Gar. Co., Md.	1937	49	18	67
Chippewa Average		66	13	79
Katahdin, Maine	1932	126	13	139
Katahdin, Eastern Shore, Md.	1934	61	3	64
Katahdin, Eastern Shore, Md.	1935	166	24	190
Katahdin, Gar. Co., Md.	1936	70	12	82
Katahdin Average		106	13	119
Warba, Gar. Co., Md. Stored seed	1936	45	7	52
Warba, Gar. Co., Md. Stored seed	1937	42	35	77
Warba stored seed average		44	21	65
Warba, Eastern Shore, Md. Spring crop treated	1936	79	29	108
Warba, Eastern Shore, Md. Spring crop treated	1937	135	65	200
Warba spring seed treated Average		107	47	154
Irish Cobbler, Maine		34	25	59
Irish Cobbler, Gar. Co., Md.		98	15	113
Irish Cobbler, Gar. Co., Md.		46	18	64
Irish Cobbler, Gar. Co., Md.		36	38	74
Irish Cobbler Average		54	24	78
Irish Cobbler, Maine		79	14	93
Irish Cobbler, E. Shore, Md.		28	20	48
Irish Cobbler, E. Shore, Md.		87	10	97
Irish Cobbler, Gar. Co., Md.		49	15	64
Irish Cobbler Average		61	15	76
Irish Cobbler, Gar. Co., Md. Stored seed		49	15	64
Irish Cobbler, Gar. Co., Md. Stored seed		36	38	74
Irish Cobbler stored seed ave.		43	27	70
Irish Cobbler, E. Shore, Md. Spring crop treated		21	7	28
Irish Cobbler, E. Shore, Md. Spring crop treated		23	22	45
Irish Cobbler spring crop Treated average		22	15	37

been outyielded consistently by the Warba and Katahdin varieties, and the Chippewa variety has yielded about the same. Although these varieties have many good qualities, it is felt that none of them is sufficiently superior to warrant any grower in substituting them for the Irish Cobbler. However, under certain conditions, the Eastern Shore potato grower may find it profitable to use them for planting a portion of his crop.

Chippewa.* The Chippewa potato has been studied on the Maryland Eastern Shore since 1935. Mild mosaic has never been observed on any Chippewa potatoes grown in Maryland, and its originators (7) report it to be resistant to the disease. It is a smoother potato than the Irish Cobbler, with shallower eyes. It is a round potato but is somewhat longer than the Irish Cobbler. When grown on the Maryland Eastern Shore, it is one week to ten days later than the Irish Cobbler. Differences in yield obtained from Chippewa and Irish Cobbler potatoes, when planted for the early and late potato crops, were not significant; see Tables X and XI. Storage rot has usually been more prevalent in Chippewa potatoes than in Irish Cobblers when both varieties were kept in the same storage (unheated basement). Leaf roll has developed more rapidly in Chippewa potatoes than in Irish Cobbler potatoes in Maryland; see Table VII. Where a smoother potato which is one week to ten days later than the Irish Cobbler is desirable, it is recommended for trial planting.

Earlaine. The Earlaine is a new early potato variety which was developed recently by the United States Department of Agriculture (8). It is a round potato, which is smoother and has shallower eyes than the Irish Cobbler and is just as early. It is reported by its originators to be resistant to mild mosaic. It was compared with the Irish Cobbler variety for planting the early crop on the Maryland Eastern Shore in 1937, 1938, and 1939. In 1939 the stand of Earlaine potatoes was so poor that no yield records were kept. Difference in yield between Earlaine and Irish Cobbler potatoes in 1937 and 1938 was not significant (see Table X). Tests with the Earlaine potato have not been conducted long enough to draw conclusions regarding its adaptability for planting in Maryland, and it is recommended to the potato grower only for trial planting in comparison with the Irish Cobblers.

Katahdin. The Katahdin was the first of the new potato varieties to be developed as a result of the recent potato breeding program inaugurated by the U. S. Department of Agriculture (7). It is a smooth, round potato with shallower eyes than the Irish Cobbler, and, in Maryland, it is ten days to two weeks

*Original seed stocks of Chippewa, Earlaine, and Katahdin potatoes were obtained through courtesy of Dr. F. J. Stevenson and Dr. C. F. Clark, Division of Fruit and Vegetable Crops and Diseases, Bureau of Plant Industry, U. S. Dept of Agriculture.

later. No mild mosaic has ever been observed in Katahdin potato plots in Maryland, and its originators report it to be resistant to the disease. It has been compared with the Irish Cobbler variety for early and late planting on the Maryland Eastern Shore since 1932, and its average yield has been larger than the Irish Cobbler (see Tables X and XI). It is recommended for planting the early and late crop on the Maryland Eastern Shore where a smoother potato which is ten days to two weeks later than the Irish Cobbler is desired.

Warba*. The Warba is a new early potato originated by the Minnesota Experiment Station (21). It is almost the same shape as the Irish Cobbler but has a cream-colored skin and pink eyes, which are fully as deep as, if not slightly deeper than, the Irish Cobbler. It is a week to ten days earlier than the Irish Cobbler. It has been compared with the Irish Cobbler on the Maryland Eastern Shore since 1936. Mild mosaic has never been observed in Warba potato plots in Maryland, and its originators report it to be resistant to the disease. Although the difference in yield was usually in favor of the Warba variety, it was not usually sufficient to be considered significant (see Tables X and XI) except where spring-grown, treated seed was used for planting the late crop. Observations made on the Warba potato indicate that under Maryland conditions it is more susceptible to scab and late blight rot than the Irish Cobbler variety, and it also seems to develop leaf roll more readily (see Table VII). It has two decided advantages over the Irish Cobbler, one, its earliness, and the other, the fact that treated, spring-grown seed can be used successfully for planting the late crop. However, it is very questionable whether these advantages sufficiently outweigh its disadvantages to make its substitution for the Irish Cobbler variety desirable for the Eastern Shore potato grower.

Other Varieties. The Nittany Cobbler variety, which originated in Pennsylvania,† was compared with the Irish Cobbler variety on the Maryland Eastern Shore in 1937 and 1938. The characteristics of the two varieties were so similar that it was thought best to classify the Nittany Cobbler as a strain of the Irish Cobbler. The Houma variety‡ was tested for planting the early crop, but tuberization was so late that only a poor crop of small tubers was produced. In 1938 and 1939 the White Rose variety was tested in comparison with the Irish Cobbler for planting the early crop. In 1938 the White Rose yielded 158 bushels of prime potatoes per acre, compared with an average

*Original seed stock was obtained from Grand Rapids Experimental Farm through the courtesy of A. G. Tolaas, University Farm, St. Paul, Minnesota.

†Original seed stock was received from E. R. Blass, Condersport, Pennsylvania, through courtesy of E. L. Nixon, Professor of Plant Pathology, Pennsylvania State College.

‡Originated by U. S. Department of Agriculture (9).

of 209 bushels of prime potatoes per acre for the Irish Cobbler; and in 1939 the plot of White Rose potatoes was so poor that it was not worth harvesting. It is evident that neither the Houma nor the White Rose variety is suitable for planting the early potato crop on the Maryland Eastern Shore.

Ninety-three samples of seedling potatoes obtained from the United States Department of Agriculture* were planted in small plots at Pocomoke† in 1939. Plots of Irish Cobblers and Warbas were interspersed at equal intervals for comparison. It was impossible to obtain accurate yield records on account of the small size of the plots, but some idea of their prolificacy was obtained by digging each plot by hand, weighing the tubers and computing the yield per plant. Forty-seven of the seedlings yielded almost as well as, or better than, the Irish Cobbler and Warba varieties. Many of these seedlings were just as early as, and bore smoother tubers than, the Irish Cobbler and Warba varieties. These studies will be continued.

SPRAYING AND DUSTING STUDIES

Potato spraying and dusting tests were begun in Worcester County, in cooperation with the Department of Entomology, in 1931. The dusting experiments were discontinued in 1934, but the spraying experiments have been continued to the present time. In a publication by Jehle, Cory, and Grant (15), the results of spraying and dusting tests conducted in 1931, 1932, and 1933 were summarized as follows:

"In spraying tests conducted over a period of three years on six crops of Irish Cobbler potatoes on the Eastern Shore of Maryland, an average increase of 49 bushels of primes (Graded U. S. No. 1 and U. S. No. 2) per acre and a total average increase in yield of 37 bushels per acre was obtained by spraying the fields with Bordeaux Mixture and calcium arsenate instead of following the usual practice of spraying or dusting them with an arsenical only. The injury to the field sprayed with Bordeaux Mixture and calcium arsenate from early blight, flea beetle, and leaf hopper was found to be much less than it was in fields treated with an arsenical only. In a test with dust on the early and late crop of Irish Cobbler potatoes on the Eastern Shore of Maryland, an average increase of 42 bushels per acre of primes and a total average increase of 13 bushels per acre were obtained in the early crop. An average increase in yield of 55 bushels per acre of primes and the same increase in total yield were obtained in the late crop. In the early crop the increase in yield due to dusting with monohydrated copper-lime dust was not as great as the increase

*Received through courtesy of F. J. Stevenson and C. F. Clark, U. S. Dept. of Agriculture, Division of Fruit and Vegetable Crops and Diseases.

†Farm of Willard T. Pilchard.

in yield due to spraying with Bordeaux calcium arsenate, but in the late crop it was greater. The addition of nicotine sulphate to the spray or dust did not increase the yield when aphids were present only in small numbers.

"Owing to these results, it is believed that it will be profitable for all potato growers on the Eastern Shore of Maryland to spray their fields with Bordeaux Mixture 4-4-50 with the addition of two pounds of calcium arsenate to every 50 gallons of mixture, beginning when the vines are approximately six inches high or earlier if any flea beetles or leaf hoppers are observed. The second application should be made about two weeks later, followed by applications at seven- to ten-day intervals. Spraying should be continued until the vines are fully matured. Applications should be more frequent when flea beetles and leaf hoppers are numerous and when the weather is cool and wet. If spraying is impractical for any reason, dusting with monohydrated copper-lime dust is recommended, applications to be made at the same intervals as spraying. When aphids are numerous, the addition of one-half pint of nicotine sulphate to every 50 gallons of Bordeaux Mixture or when the vines are dusted, an additional dusting with 3% nicotine dust is recommended."

Since 1934, many spray materials have been compared with Bordeaux Mixture and calcium arsenate for spraying the early and late potato crop on the Eastern Shore. With the exception of yellow cuprous oxide*, none gave as good results as Bordeaux Mixture. Similar results have been obtained in spraying tests conducted at Accomack, Virginia (1). Further tests with yellow cuprous oxide must be made before its value for potato spraying can be determined.

DISCUSSION AND SUMMARY

In response to requests from potato growers on the Maryland Eastern Shore for information on the control of diseases and other factors which were resulting in reduced yields and inferior quality, studies were made in comparison of various sources of seed for the early potato crop, effect of various storage temperatures on the late home-grown seed potato crop, best practices for the production of a late healthy seed crop, studies with the use of seed potatoes from the early crop for planting the late seed crop, studies of potato varieties with special reference to disease resistance, and spraying and dusting studies.

The following conclusions have been reached as a result of these studies:

1. The use of certified seed for production of the early Eastern Shore potato crop is more likely to result in freedom from

*49% metallic copper with wetting and spreading agents added.

diseases, good quality, and satisfactory yields than the use of uncertified seed.

2. Yields, quality, and disease prevalence varied in plots grown from certified seed produced in different localities, but there was just as much variation in plots grown from certified seed produced by different growers in the same locality. In the purchase of certified seed for the early potato crop, it is more important for the Eastern Shore potato grower to be guided by the reputation of individual seed growers than by the reputation for certified seed potato production of the locality in which the seed potatoes are grown.

3. When stored at a temperature of 40° F., or in an unheated basement during the entire storage period, late Eastern Shore grown Irish Cobbler seed potatoes come up and mature a week to ten days later than northern-grown or mountain-grown seed, when planted for the production of the early Eastern Shore potato crop.

4. By storing them at a higher temperature, either during the entire storage period or after the rest period is over (approximately the middle of January), sprout development is stimulated, and they come up and mature earlier.

5. The effect of raising the storage temperature of late-grown Eastern Shore Irish Cobbler seed potatoes on yield was found to vary with the season. If the early part of the season was dry and rains came late, seed which germinated and matured latest usually yielded best. If, on the other hand, the rains came early and the soil dried out during the latter part of the growing season, the seed which emerged and matured earliest gave the largest yield. Yields from the early emerging and maturing seed were also found to be the largest in soils which had good water-holding capacity.

6. Results indicated that the following practical methods can be employed for stimulating sprout development of late home-grown Irish Cobbler seed stock: Raising the storage temperature of unheated storage houses to 60° to 65° F. after January 15, or to 80° F. for a period of about two weeks before planting, with heating devices, keeping the seed potato stock in sweet potato storage houses during the entire storage period, or removing the seed potatoes from unheated basements to brooder houses for a period of about two weeks before planting.

7. No significant difference was found in the percentage of plants affected with virus diseases in plots grown from seed stocks kept at various storage temperatures.

8. Late Eastern Shore grown seed stock proved to be just as good as, and frequently better than, northern-grown and Garrett County grown seed stock in tests conducted in Garrett County.

9. The control of virus diseases in late Eastern Shore grown seed stock was found to be more difficult than the control of virus diseases in Garrett County seed stock.

10. Renewal of the seed stock at least every other year, and preferably every year, was found be to necessary for production of desirable late-grown Irish Cobbler Eastern Shore seed stock.

11. Only registered seed, or certified seed grown in fields in which practically no plants affected with virus diseases could be found, is safe for renewal of late Eastern Shore grown seed stock.

12. Potato tubers from the early Maryland Eastern Shore potato crop can be used successfully for planting the late seed crop, if the cut tubers are soaked for one hour in a solution of sodium thiocyanate (1 pound to 12 gallons of water)and planted immediately.

13. Treated spring-grown tubers are slower in coming up than stored tubers from the previous year and should be planted two weeks earlier.

14. Different varieties of potatoes vary in their response to the treatment.

15. Yields and stands from the treated, spring-grown Warba potatoes were approximately the same as yields and stands from stored Warba potatoes. Yields and stands from spring-grown Katahdin and Chippewa potatoes were approximately 75% of yields and stands from stored Katahdin and Chippewa potatoes, and the yields and stands from spring-grown treated Irish Cobbler, Bliss Triumph, and Earlaine potatoes were approximately 50% of the stands and yields from stored Irish Cobbler, Bliss Triumph, and Earlaine potatoes.

16. Repetition of the treatment for a period of five successive years had no effect on the vitality of the seed stock.

17. Repetition of the treatment for two successive years caused a large increase in the percentage of leaf roll infection in Warba seed stock in spite of careful roguing. This indicates the difficulty which would be involved in control of virus diseases should the practice of growing late seed crops from treated, spring-grown seed become general on the Maryland Eastern Shore.

18. No significant difference in yield was obtained between plots of late-grown Irish Cobbler potatoes planted with spring-

grown seed treated for one hour and spring-grown seed treated for one and one-half hours with the sodium thiocyanate solution.

19. Out of 33 early seedlings tested, six gave just as good results as the Warba variety when treated, spring-grown seed was used to plant the late Eastern Shore crop.

20. Since 1932, comparative studies between various potato varieties have been made on the Maryland Eastern Shore. As a result of these studies the Irish Cobbler is still recommended as the most profitable variety to grow for production of the early potato crop and the late seed potato crop.

21. The Warba may prove valuable for Eastern Shore growers who want a potato which is earlier than the Irish Cobbler, and for growers who wish to use spring-grown seed for producing the late crop.

22. The Katahdin potato has outyielded the Irish Cobbler variety in tests conducted on the Maryland Eastern Shore since 1932. It is recommended for planting the early and late potato crop on the Maryland Eastern Shore where a smoother potato which is ten days to two weeks later than the Irish Cobbler is desired.

23. The Earlaine and Chippewa varieties are recommended for trial planting to Eastern Shore potato growers who are interested in smoother potatoes with shallower eyes than the Irish Cobbler. The Earlaine potato matures at about the same time as the Irish Cobbler, and the Chippewa matures one week to ten days later.

24. As a result of preliminary studies with 93 early and medium early potato seedlings obtained from the United States Department of Agriculture, there is every indication that new varieties for early planting on the Maryland Eastern Shore can be found which will be superior to the Irish Cobbler in yield, quality, and disease resistance.

25. Spraying or dusting potato vines for control of insects and diseases is recommended to all Eastern Shore potato growers. Best results can be expected from spraying the vines with Bordeaux Mixture 4-4-50 with the addition of 2 pounds of calcium arsenate to every 50 gallons of the mixture, beginning when the vines are approximately six inches high, or earlier if any flea beetles or leaf hoppers are observed. The second application should be made about two weeks later and should be followed by applications at seven- to ten-day intervals until the vines are mature. Applications should be more frequent when leaf hoppers and flea beetles are numerous and when cool, wet weather makes conditions favorable for late blight development. If spraying is

impractical for any reason, dusting with monohydrated copper-lime dust is recommended, applications to be made at the same intervals as spraying. When aphids are numerous, the addition of one-half pint of nicotine sulphate to every 50 gallons of Bordeaux Mixture, or when the vines are dusted, an additional dusting with 3% nicotine dust is recommended.

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